



Molecular and Neural Correlates of Memory and Cognition

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Session 2

Neural mechanisms underlying memory and cognition

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To eat? To sleep? To run? Neural dynamics of innate behaviors

Lateral hypothalamus (LH) is crucial for the regulation of innate behaviors, including food intake, locomotion and sleep-wake cycle. Combining optogenetics with electrophysiological recordings in behaving mice, we characterized state- and behavior-dependent activity of neuronal subpopulations in the LH, including GABA cells (Carus-Cadavieco et al., Nature 2017, Herrera et al., Nat. Neurosci, 2016, Bender et al., Nat. Comm, 2015). We have identified a novel top-down pathway from medial prefrontal cortex via lateral septum to lateral hypothalamus, which utilizes gamma synchronization (30-90 Hz) to regulate food-seeking by dynamic reorganization of functional cell groups in the LH. This gamma-rhythmic input enables fine-time scale separation of LH cells according to their feeding-related activity. We have found that neuronal populations in the lateral hypothalamus, as well as top-down gamma-rhythmic signaling, differentially code food-seeking and food intake. Currently we investigate functions of further neurochemically defined cell groups in the LH, using calcium imaging in behaving mice, and map a sub-second structure of behavioral patterns upon manipulations of activity of these cells.

